

AD-756 891

SEISMIC DATA LABORATORY QUARTERLY
TECHNICAL SUMMARY REPORT, OCTOBER-
DECEMBER 1972

Robert R. Blandford

Teledyne Geotech

Prepared for:

Advanced Research Projects Agency

15 January 1973

DISTRIBUTED BY:

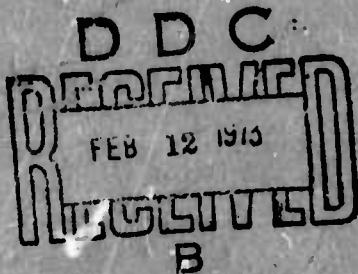
NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

AD756891



SEISMIC DATA LABORATORY QUARTERLY TECHNICAL SUMMARY REPORT OCTOBER - DECEMBER 1972



JANUARY 19, 1973

Prepared for
AIR FORCE TECHNICAL APPLICATIONS CENTER
Washington, D.C.

Under
Project VELA UNIFORM

Sponsored by
ADVANCED RESEARCH PROJECTS AGENCY
Nuclear Monitoring Research Office
ARPA Order No. 1714

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

DISTRIBUTION STATEMENT A
Approved for public release
Distribution Unlimited



TELEDYNE GEOTECH

ALEXANDRIA LABORATORIES

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

14 R

Neither the Advanced Research Projects Agency nor the Air Force Technical Applications Center will be responsible for information contained herein which has been supplied by other organizations or contractors, and this document is subject to later revision as may be necessary. The views and conclusions presented are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the Advanced Research Projects Agency, the Air Force Technical Applications Center, or the U S Government.

ACQUISITION FOR	
ITEM	White Bulletin <input checked="" type="checkbox"/>
U.S.	Red Bulletin <input type="checkbox"/>
UNCLASSIFIED	<input type="checkbox"/>
JUSTIFICATION	
BY	
DISTRIBUTION/AVAILABILITY CODES	
Dist.	AVAIL. Rmk./w SPECIAL
A	

Unclassified

Security Classification

DOCUMENT CONTROL DATA - R&D		
(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)		
1. ORIGINATING ACTIVITY (Corporate author) Teledyne Geotech Alexandria, Virginia		2a. REPORT SECURITY CLASSIFICATION Unclassified
		2b. GROUP
3. REPORT TITLE SEISMIC DATA LABORATORY QUARTERLY TECHNICAL SUMMARY REPORT OCTOBER - DECEMBER 1972		
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Scientific		
5. AUTHOR(S) (Last name, first name, initial) Blandford, Robert R.		
6. REPORT DATE 15 January 1973	7a. TOTAL NO. OF PAGES 13	7b. NO. OF REFS
9a. CONTRACT OR GRANT NO. F33657-72-C-0009	9b. ORIGINATOR'S REPORT NUMBER(S)	
b. PROJECT NO. VELA T/2706		
c. ARPA Order No. 1714	9d. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
d. ARPA Program Code No. 2F10		
10. AVAILABILITY/LIMITATION NOTICES APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.		
11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY Advanced Reserach Projects Agency Nuclear Monitoring Research Office Washington, D. C.	
13. ABSTRACT This report summarizes the work done by the SDL during the period October through December 1972, and primarily concerns the seismic research activities related to the detection and identification of nuclear explosions and earthquakes. The report also contains brief discussions of the support tasks and data services which were performed for other government contractors and for participants in the VELA-UNIFORM and PRIME ARGUS projects.		
14. KEY WORDS Seismic Data Laboratory - Quarterly Technical Summary VELA-UNIFORM Project		

I

Unclassified

Security Classification

SEISMIC DATA LABORATORY
QUARTERLY TECHNICAL SUMMARY REPORT
October - December 1972

AFTAC Project No.:	VELA T/2706
Project Title:	Seismic Data Laboratory
ARPA Order No.:	1714
ARPA Program Code No.:	2F-10
Name of Contractor:	TELEDYNE GEOTECH
Contract No.:	F33657-72-C-0009
Date of Contract	01 July 1971
Amount of Contract:	\$2,482.460
Contract Expiration Date:	30 June 1973
Project Manager	Robert R. Blandford (703) 836-3882

P. O. Box 334, Alexandria, Virginia 22314

APPROVED FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED.

II

TABLE OF CONTENTS

<u>SECTION</u>		<u>PAGE NO.</u>
I.	ABSTRACT INTRODUCTION	1
II.	WORK COMPLETED	1
	A. Spectral Whitening with Application to Explosion pP, No. 282	
	B. Coda Suppression Capabilities of the Beam and Mixed-Signal Processor, No. 298	
III.	SUPPORT AND SERVICE TASKS	2
	A. Data Cataloging, Classifying and Retrieval	3
	B. Equipment Modifications	5
	C. Maintain and Operate Equipment	5
	D. Digital Programming	5
	E. VELA and PRIME ARGUS Data Copies	6
	F. Analog Field Tape Supply	7
	G. Array Data Service	7

III

I. INTRODUCTION

This quarterly report summarizes the technical work, support effort, and data services completed during the period October through December 1972.

Reviews of technical reports completed during the reporting period are contained in Section II under descriptive headings. Section III is a summary of the support and service tasks performed for other government contractors for VELA-UNIFORM and PRIME ARGUS participants.

The feasibility studies for long period seismic arrays have been delivered to VSC. A preliminary first draft for analysis assignment 2-73, an engineering study of seismic networks, will be delivered to VSC on January 15, 1973. Delivery of a final draft is scheduled for February 15, 1973.

II. WORK COMPLETED

A. Spectral Whitening with Application
to Explosion pP, No. 282

A method was developed for whitening the spectra of teleseismic P waves to aid in the determination of events depths. The method uses a network of common recording stations, all of which

must have recorded signals from a suite of closely-spaced events, e.g., a set of underground explosions. Individual spectra are whitened by removing a path-recording site response determined by averaging spectra from the suite of events as recorded at a single station. The whitened spectra from a single event are then summed over the recording network to yield a whitened source spectra. The whitening process enhances spectral components in the band 2 to 5 Hz. Application of the proposed whitening method to explosion spectra for theoretical and experimental data sets indicates that the method may be useful in analyzing spectral nulls provisionally interpreted as due to pP-P interference. Depth-phase analysis for seven NTS explosions, using both whitened and unwhitened data, shows that spectral nulls are enhanced in the whitened spectra. Network summed spectra (unwhitened) for seventeen earthquakes are also included; these demonstrate the fact that nulls can be caused, for example, but multipath effects

and multiplet sources as well as by depth-phase interference.

B. Coda Suppression Capabilities of
the Beam and Mixed-Signal Processor,
No. 298

Using 7- and 19- element subarray at TFO we compared the relative abilities of the beam and a mixed-signal processor to attenuate P-wave codas. P-wave signals from various earthquakes were time-shifted to simulate arrivals from different azimuths and 60° distance. These signals were assumed to mask an explosion detonated at Semipalatinsk, about 96° distant from TFO. The analysis consists of determining how much of signal 1 (the earthquake) leaks into our estimate of signal 2 (the event being masked). Because the beam and mixed-signal processor are linear processors, signal 2 need not actually be present; we need only determine how much of signal 1 is present in our estimate of signal 2.

The coda attenuation capability of the mixed-signal processor was found to exceed that of the beam. Up to 14 db improvement over the beam was obtained, although improvement was generally on the order of 3 to 5 db for both subarrays. A nominal value of 18 db was representative of the maximum coda attenuation obtained using the mixed signal processor and the 19-element subarray; for the 7-element subarray, maximum attenuation is roughly 14 db. Coda attenuation obtained using the 7-element subarray and the mixed-signal processor was comparable to that obtained using the 19-element subarray and the beam.

III. SUPPORT AND SERVICE TASKS

In addition to the research studies discussed above the SDL completed the following support and service tasks:

A. Data Cataloging, Classifying and
Retrieval

The library consists of seismograph data from the LRSM sites, the observatories LASA, TFO, UBO, WMO, BMO, CPO and additional data from other sources. The corresponding operational logs are also included in the library.

At the end of December 1972, the library contained approximately:

34,264	analog magnetic tapes
21,062	digitized seismograms
5,679	digital magnetic tapes

The library also contains seismographic data on 16 mm and 35 mm film. Those are commonly from simultaneous recording of tape and film data at the observatories and the LRSM sites.

The following categories of digital tapes are in the library:

281	UBO multiplexed
1,199	LASA multiplexed
754	TFO long period (DGRADAS tapes)
598	TFO Short period (ASDAS tapes)

2,032	Library tapes (A/D and D/D conversions)
912	Permanent Save Tapes
1,690	Operations tapes (scratch, save, etc.)

The analog tape library contains:

9,279	Compressed tapes
332	Composites
17,412	Tapes saved as recorded (not compressed)
7,426	Tapes scheduled for compression as time permits

Data tapes from the Queen Creek (QCAZ) project were received during December. Of the 1288 tapes generated during this project 978 are in Alexandria and 310 are temporarily retained in Garland, Texas.

One half inch analog tapes from six portable strain meter sites in Southern Nevada were received during December. There are 176 tapes in this category.

As a result of our request, data from four array sites EKA, WRA, GBA and YKA have been received. Eleven tapes were copied, one-to-one on 66 one inch analog tapes. The increase in the number of copy tapes results from the twenty four data channels and the three days time duration of each tape.

B. Equipment Modifications

Work continued on building the CALCOMP interface for the PDP 15/50. The anticipated completion date is January 18.

C. Maintain and Operate Equipment

No significant PDP 15/50 equipment malfunctions occurred during the month.

D. Digital Programming

Several software bugs in the DEC supplied Object Time Library have been uncovered. An attempt is being made to obtain current versions of these routines from another PDP user before contacting DEC or attempting in house corrections. Documentation on program FETCH was delivered to VSC.

A pre-release version of the RSX Phase 2 Disk Pack handler has been installed. DEC will officially release this package later this month and charge for any support that we request. Preliminary specifications for the SDAC system design and users manual are continuing. These documents should be finished by mid-January.

Progress on the SDT will be reported in a separate document.

E. VELA and PRIME ARGUS DATA copies

During the past year SDL supplied data or computer services to the following:

ACDA, Department of State, Washington, D. C.

Air Force Cambridge Research Laboratory

Air Force Office of Scientific Research

Brown University

California Institute of Technology

Commonwealth of Australia, Dept. of Natl. Development

Dept. of Energy, Mines, and Resources, Ottawa, Canada

General Atronics Corporation

IBM

Institute of Geophysics, Victoria University

Lawrence Livermore Laboratories

MIT, Lincoln Laboratory

Naval Research Laboratory, Washington, D. C.

Pennsylvania State University

Royal Norwegian Council for Scientific and Industrial
Research

Southern Methodist University

University of Alaska

University of California, San Diego

University of Edinburgh

Universtie Louis Pasteur

University of Texas at Dallas

University of Washington at Seattle

University of Wisconsin

U. S. Arms Control and Disarmament Agency

U. S. Department of Commerce, National Oceanic
and Atmospheric

F. Analog Field Tape Supply

During December, 1050 one inch analog tapes were shipped to Garland for field use. As a result of compression 382 tapes are available for field use.

G. Array Data Service

LASA weekly event summaries through 31 December 1972, were distributed to 32 addressees approved by the government. No NORSAR short period data samples were requested during November.